

**UNITED STATES DISTRICT COURT  
FOR THE EASTERN DISTRICT OF VIRGINIA  
RICHMOND DIVISION**

SIERRA CLUB,

Plaintiff,

VIRGINIA ELECTRIC AND POWER  
COMPANY d/b/a DOMINION VIRGINIA  
POWER

Defendant.

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Case No. 2:15-cv-00112-RAJ-DEM

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**DEFENDANT VIRGINIA ELECTRIC AND POWER COMPANY'S  
SUMMARY OF EXPERT OPINIONS**

Pursuant to the Court's Order on June 24, 2016 [ECF 169], Dominion respectfully provides the Court with a summary of the opinions of its and Sierra Club's testifying experts.

**Dominion's Testifying Experts**

1. **Daniel B. Stephens, Ph.D.** – Expert in hydrology, pore water, monitored natural attenuation, landfill closure and the landfill capping system. Trial Tr. Vol III 693:14-22.
  - A. **Pore water samples do not indicate that groundwater containing arsenic from the CEC site discharges to the river.**
    - 1) Higher concentrations of arsenic were generally found in shallower depths near the river bottom, rather than deeper depths closer to groundwater movement. Trial Tr. Vol. III 696:2-9; 697:2-25. This suggests the source of arsenic is coming from the river (and industries upstream and downstream) and not groundwater. Trial Tr. Vol. III 698:16-24; 696:6-12; 709:1-710:13; Dom. Ex. 211.
    - 2) Concentrations of arsenic in groundwater wells was lower than concentrations of arsenic in pore water samples taken nearby, also suggesting that

groundwater is not the source of pore water arsenic. Trial Tr. Vol. III 714:11-716:22.

- 3) In order to explain why pore water concentrations are higher near the river bottom versus deeper, Plaintiff's theory is that groundwater flows horizontally in the area within a few feet/inches of – or parallel to – the river bottom and then takes a sharp turn vertically to discharge – perpendicularly – to the river. Hydrologic principles do not support this theory – water does not flow horizontally near a river bottom but rather moves gradually upward from greater depths. Trial Tr. Vol. III 708:7-14; 709:13-16; 709:19-710:13
- 4) Arsenic moves slower than groundwater. Trial Tr. Vol. III 718:2-8. A prior site-specific analysis at CEC, the URS Assessment of Corrective Measures, Dom. Ex. 1a at DOM00006604 -6605, found arsenic at CEC has a retardation factor of 87, meaning that it travels at 1/87<sup>th</sup> the rate of groundwater. As further determined in Dom Ex. 1a, groundwater at the site moves between 1.73 feet to 324 feet per year. Applying the CEC-specific retardation factor, arsenic would travel between 0.02 feet to 3.30 feet per year. At this rate, arsenic may not have reached beyond the boundaries of the CEC site. Trial Tr. Vol. III 718:9-720:6.

**B. The landfill is functioning as designed and there is no evidence that the landfill liner is leaking in any way that would influence groundwater flow.**

- 1) The leachate collection system, perimeter ditch, and sedimentation pond are functioning as designed to manage seeps and leachate. Trial Tr. Vol. III 726:4-728:22.
- 2) Sierra Club expert Mr. Brown contends that four gallons-per-minute (gpm) may be leaking through the landfill liner. Four gpm over the 22-acre landfill site is the equivalent of a moderately flowing garden hose watering 22 football fields. This rate is not sufficient to cause noticeable groundwater movement. Trial Tr. 724:7-726:3. The alleged flow rate is based on the HELP computer model, which used assumed conditions, but was not based on any actual measurements. Trial Tr. Vol. III 723:25-726:3.

**C. Monitored Natural Attenuation (MNA) has been successful since it was implemented and is reasonably likely to be effective in the future.**

- 1) Groundwater wells, particularly those that have been continually monitored since 1983 until present, show a declining trend with concentrations of arsenic decreasing from as high as 4,000 ug/l to 22 ug/l in a single well. Several of these wells have now reached *drinking* water standards for arsenic. Trial Tr. Vol. III 728:23-730:2.

- 2) A plot of arsenic concentrations of all wells over time also shows a significant declining trend. Trial Tr. Vol. III 730:11-732:13.
- 3) A review of arsenic concentrations in groundwater wells, when compared to location of those wells, suggests a peninsula-wide remedial approach is not necessary. Trial Tr. Vol. III 732:14-733:16.

**D. The landfill closure plan is reasonable, and will essentially halt seepage into the landfill, will considerably slow groundwater flow, and should be implemented before deciding if MNA is functioning properly.**

- 1) The cap over the landfill will consist of a vegetative cover, a geo-composite drainage layer, and a textured HDPE impermeable liner. Installation will halt water seepage into the landfill and any water that runs off the liner will be “clean” as it will not come into contact with coal ash. Trial Tr. Vol. III 735:18-736:21. Likewise, the sedimentation pond, which will remain active to treat stormwater flows and leachate from the closed landfill, will be lined further preventing groundwater flow. Trial Tr. Vol. III 737:12-24.
- 2) Installation of the liners will result in a decline in the water table, reduced groundwater movement, reduced arsenic movement, and a return of the natural upward gradient (which has already begun to occur with cessation of plant operations). An improved leachate collection system will also help prevent inflow to the dry ash in the landfill. These changes will benefit MNA and should be implemented before reassessment of whether MNA will be effective over the long term. Trial Tr. Vol. III 737:12-24; 737:25--743:8.

**2. Wade Nutter, Ph.D., PH – Expert in hydrology and surface water.** Trial Tr. 761:16-21.

**A. There is no evidence that the surface water quality has changed as a result of arsenic in groundwater and all surface water samples are within EPA and DEQ water quality criteria.**

- 1) At least seventy-three surface water samples have been taken over the past thirteen years. No sample has ever shown evidence that the water quality in the surface waters has changed because of CEC. Trial Tr. Vol. III 764:7-12.
- 2) No sample exceeded the water quality standard for arsenic (36 ug/L). Rather, most samples were about one-tenth the surface water standard, demonstrating that water quality for arsenic is well below regulatory criteria. Trial Tr. Vol. III 763:9-764:12; 765:14-20; Dom. Ex. 85 at DOM00275544-DOM00275544; Dom. Ex. 175; Dom. Ex. 176.
- 3) The most recent April 2016 surface water sampling included samples from within a foot of the surface, mid-depth and about a foot of the river

bottom. Dom. Ex. 85. The sampling protocol was robust by industry standards. The results of this sampling event were consistent upstream, downstream and in the vicinity of CEC and all were below the surface water standard for arsenic. Trial Tr. Vol. III 766:8-14; 765:21-766:14.

**B. There are numerous other source of arsenic in the river and, because of the ability of water and sediments to move upstream and downstream, it is impossible to tell the origin of sediments from which the pore water was taken, particularly in sediments at shallow depths near the river bottom.**

- 1) The engineering firm GHD identified numerous sources of potential arsenic contamination along the highly-industrialized River. Ex. 85 DOM00275537-DOM00275542.
- 2) Due to periodic dredging by the Army Corps, propeller wash from commercial ships, and ocean tides, water and sediment is transported both upstream and downstream of the CEC site for miles. Floating sediments would generally settle out along the banks of a shore in the “quiet water,” versus deeper water, which is a logical explanation for higher arsenic concentrations in that zone. Trial Tr. Vol. III 773:2-775:19.

**C. There is minimal tidal influence at CEC.**

- 1) As noted in the URS Assessment of Corrective Measures Report, Dom. Ex. 1A, there is very little influence of the tides on groundwater at CEC. Most significantly, well measurements taken at high tide showed little to no change in arsenic concentrations as compared to measurements at low tide. This indicates that the tides are not a significant driver of arsenic movement at the CEC site. Trial Tr. Vol. III 777:11-778:14.

**D. Groundwater impacts are not discrete or conveyances.**

- 1) Dr. Nutter testified that groundwater is a “diffuse source. It’s not a point source.” Trial Tr. Vol. III 768:2-8.

**3. Alan Mayo, Ph.D. – Expert in hydrogeology, hydrochemistry, and groundwater remediation.** Trial Tr. 829:19-830-14.

**A. The landfill liner is not leaking and there is no groundwater “mound” beneath the landfill.**

- 1) The relatively high water elevations at well CECW-3 are not due to water infiltrating from the landfill. If there were a “mound” due to liner leakage, one would expect to see uniform concentrations of arsenic in deep versus shallow wells. The opposite is true here; shallow wells (*e.g.*, closer to the

landfill) have lower concentrations of arsenic than deeper wells. Trial Tr. Vol. IV 833:9-833:24.

- 2) It is more likely that the historic high elevations at well CECW-3 resulted from water infiltration from operational sources (*e.g.*, water application for dust control and sluicing to the Bottom Ash Pond). This is supported by the fact that water elevations at CECW-3 have dropped significantly since the plant ceased operations in 2014. Trial Tr. Vol. IV 855:25-856:10.

**B. The hydrogeologic features in and around CEC have significant amounts of clay materials and a natural upward gradient which impedes groundwater – and thus any associated arsenic – movement both horizontally and vertically.**

- 1) Of the seventeen well drilling logs, thirteen indicate that “clay” was the primary constituent encountered (being at least 50% of the material encountered). Clay impedes the movement of groundwater both vertically and horizontally. Trial Tr. Vol. IV 845:3-836:4; 847:4-8; 849:20-25.
- 2) There is a natural upward gradient at the CEC site. An upward gradient means that “natural forces push up on groundwater, which limits groundwater movement outward.” Once the landfill cap is put in place, the upward gradient should become even more prominent, and further inhibit groundwater movement. Trial Tr. Vol. IV 841:10-23.

**C. Groundwater data demonstrate that MNA is working.**

- 1) Arsenic concentrations are decreasing along the groundwater flow path as evidenced by the arsenic concentrations at wells along that flow path. For example, arsenic concentrations move from 200 ug/L at well CECW-3, to 75 ug/L at well CEC 10-R, then to at or below the detection limit at well CECW-15. Trial Tr. Vol. IV 852:1-854:1.

**4. Christopher Teaf, Ph.D. – Expert in Toxicology.** Trial Tr. Vol. IV 880:2-16.

**A. There are no human health impacts or ecological impacts of concern from the CEC site.**

- 1) A review of surface water data, pore water data and fish tissue data indicates that arsenic concentrations in and around the CEC site are not harmful to humans or the environment. Trial Tr. Vol. IV 885:16-20.
- 2) The fish tissue study reviewed was conducted by EPA and VDEQ over an 11 year period and included species that were filter feeders and benthic species (*e.g.*, those that live at the river bottom). Arsenic concentrations in these species were below levels of concern and in most instances below the detection limit for arsenic. Trial Tr. Vol IV 884:6-885:17.

5. **John Glover – Expert in Costs & Methods of Excavation.** Trial Tr. Vol. IV 889:23-890:2.

A. **If required, excavation of the CEC site would cost \$607 million and would take thirteen years.**

- 1) If required, excavation of the CEC site would cost approximately \$382,126,000 and disposal an additional approximately \$225,532,000, for a total cost of approximately \$607,658,000. Trial Tr. Vol. IV 893:19-22; 894:19-23 (Mr. Glover); Dom. Ex. 116, 117.
- 2) Excavating and disposing of the coal ash at CEC would be an extensive endeavor requiring new or modified federal, state and local permits, engineering designs, weight, volume and hauling logistics, site preparation, dewatering including water treatment, backfilling and final closure. *See* Trial Tr. Vol. IV 890:5-921:13 (Mr. Glover).
- 3) Excavation of the CEC site would take thirteen years, including the time required to obtain necessary permits. Trial Tr. Vol. IV 918:20-23. Dom. Ex. 116.

B. **If required, excavation of the CEC site, less the acreage of the CNG site, would cost \$476 million and take ten years.**

- 1) If the CNG site were excluded, the total cost would be approximately \$476,599,000 (\$299,163,000 for excavation and \$177,436,000 for disposal). Trial Tr. Vol. IV 893:19-22; 894:19-23 (Mr. Glover); Dom. Ex. 116, 117.
- 2) Excavation would take ten years, including time to obtain the required permits. Trial Tr. Vol. IV 919:23-25.

**Sierra Club's Expert Witnesses**

**1. Anthony Brown**

**A. Mr. Brown acknowledges that the groundwater “mound” no longer exists.**

- 1) Mr. Brown acknowledged that with the cessation of plant operations, groundwater levels at the CEC are reducing, which represents an improvement in the site conditions. Trial Tr. Vol. I 196:6-197:3. Groundwater declines are particularly notable at well CECW-3. Trial Tr. Vol. I 230:18-19. In fact, Mr. Brown admits that the so-called groundwater “mound” no longer exists beneath the central portion of the landfill because recharge has been reduced. Trial Tr. Vol. I 139:16-24.

**B. Mr. Brown did not factor in significant differences in velocity.**

- 1) Mr. Brown did not identify the groundwater velocity at the site. Trial Tr. Vol I 206:6-15. More importantly, he acknowledged that arsenic moves slower than groundwater but did not calculate the velocity of arsenic. Trial Tr. Vol. I 206:6-23.

**C. Mr. Brown acknowledges that alleged impacts are diffuse.**

- 1) Mr. Brown described the flow of groundwater from the center of the CEC site toward the edges where ultimately the groundwater discharges to surface water. Trial Tr. Vol. I, 134:11-14.
- 2) Mr. Brown further testified, “[G]roundwater is flowing through materials that contain ash ... So that's how the different sources of ash contribute to groundwater contamination. It's either from percolation and the dissolution of constituents into that groundwater, or it's the dissolution of ash or constituents in the ash that are fully saturated with water when groundwater is flowing through those sediments.” Trial Tr. Vol. I, 126:19-127:6.

**2. Robert Parette, Ph.D.**

**A. Dr. Parette looked at the same information that DEQ has reviewed, but simply disagrees with DEQ's conclusion that MNA is appropriate for the site.**

- 1) Dr. Parette's opinions are based on data that was provided to DEQ and he conceded that based on the same data, DEQ reached a different conclusion about the efficacy of MNA. Dr. Parette confirmed that DEQ considered the same issues he had offered an opinion on in this case – redox boundaries, redox conditions, iron oxidation, arsenic adsorption, and the reducing environment – but that DEQ had found that MNA was an appropriate remedy for the CEC site. Trial Tr. Vol. II 9:13-10:13.

**B. Dr. Parette does not know what amount of arsenic, if any, is being released from the site.**

- 1) Dr. Parette does not know how much arsenic is being released into the surface waters. Dr. Parette believes that there is not enough data to determine the quantity of arsenic being released. Trial Tr. Vol. II. 12:11-20.

**C. Dr. Parrette did not identify a discrete conveyance through groundwater.**

- 1) Dr. Parette stated that whether there was a discrete conveyance through groundwater at CEC was not part of his investigation. Trial Tr. Vol. II, 15:11-16.

**3. Philip Bedient, Ph.D.**

**A. Dr. Bedient confirmed there is no discrete conveyance by which unpermitted pollutants from coal ash storage are entering surface waters, and rather described groundwater movement as diffuse in nature.**

- 1) Dr. Bedient testified, "Of course there's a ring of groundwater sources here, but *not an individual point source*." Trial Tr. Vol. II, 210:12-13 (emphasis added).
- 2) Dr. Bedient further described impacts as "coming out through the landfill" and moving "in both a vertical and horizontal direction, a radial type direction..." Trial Tr. Vol. II, 193:8-17.

**B. Dr. Bedient did not establish that excavation of coal ash is proper in this case.**

- 1) Dr. Bedient testified that the identification of a discharge standard is necessary to determine if one remedial approach is better than another. Trial Tr. Vol. II 216:22-217:1. However, Dr. Bedient could not identify a discharge standard that a remediation approach would need to meet in order to be effective or be in compliance with the Clean Water Act. Trial Tr. Vol. II 211:17-212:8.



- 2) In making his recommendation for excavation, Dr. Bedient did not consider the costs of excavation. Trial Tr. Vol .II. 21-25.

**4. John Pardue, Ph.D.**

**A. Dr. Pardue's opinion is unreliable and cannot be used to estimate costs of excavation.**

- 1) Dr. Pardue is not a licensed contractor, has never been employed in the construction industry or in the business of excavation contracting, and his license as a professional engineer has been inactive for the last five years. Trial Tr. Vol. II 177:2-13. Dr. Pardue has never had a direct role in estimating costs for an excavation project and has never been involved in a project that included excavation of coal ash. Trial Tr. Vol. II 177:14-178:1. Further, Dr. Pardue admitted that he would not bid on the entire CEC excavation project at the price he estimated without taking further steps and gathering additional information. Trial Tr. Vol. II 175:11-177:1.
- 2) Dr. Pardue did not speak to any local contractors, haulers, vendors, or landfill operators in preparing his estimate. Trial Tr. Vol. II 169:6-14. He did not investigate the permits that would be required for the project, even though he admitted that many different permits are required, and they can take years to obtain. Trial Tr. Vol. II 170:7-22.
- 3) Dr. Pardue's proposed system for treatment of wastewater during excavation would only treat arsenic and no other constituents. Trial Tr. Vol. II 153: 11-14. Dr. Pardue agrees that the draft VPDES permit for CEC requires treatment of wastewater for multiple constituents and is very similar to the VPDES permit for wastewater treatment at Bremono Bluff. Trial Tr. Vol. II 157:25-158:21. Dr. Pardue, however, did not investigate DEQ's requirements for coal ash wastewater treatment at either Bremono Bluff or Possum Point. Trial Tr. Vol. II 156:8-157:2. Dr. Pardue agrees that his estimate for the cost of wastewater treatment at CEC would go up significantly if DEQ were to impose the same requirements at CEC as it is imposing at Bremono Bluff. Trial Tr. Vol. II 158:22-159:6.
- 4) Dr. Pardue assumed that Dominion could dispose of coal ash at CEC at the SPSA landfill, but he did not know if the SPSA landfill would accept the amount and type of waste from CEC. He admitted that SPSA currently does not accept coal ash and that the SPSA board has not agreed to accept coal ash. Dr. Pardue never spoke to SPSA about whether it would accept coal ash. Trial Tr. Vol. II 165:2-9. Dr. Pardue assumed SPSA would provide a 35% discount on its tipping fees despite no basis in fact for this assumption. Trial Tr. Vol. II 165:10-167:11.

- 5) Dr. Pardue admitted it would take over 11 years to excavate all the coal ash from the CEC site. Trial Tr. Vol. II 152:7-13.

**5. Michael Kavanaugh, Ph.D.**

**A. Dr. Kavanaugh's opinions are exclusively based on Dr. Pardue's cost estimates, which are wholly inaccurate.**

- 1) Dr. Kavanaugh relied solely on the unit costs to excavate coal ash at CEC provided by Dr. Pardue as the input for calculating the purported economic benefit of non-compliance. Trial Tr. Volume II 81:1-81:5. For the reasons state above, Dr. Pardue's testimony is not reliable. As a result, Dr. Kavanaugh's testimony lacks adequate foundation because his conclusions depend on Dr. Pardue's cost estimate. Trial Tr. Vol. II 81:6-19.
- 2) Further, Dr. Kavanaugh's analysis only applies to the remedy of excavation and disposal. Accordingly, since excavation and disposal are not an appropriate remedy, Dr. Kavanaugh admits that his analysis would not apply. Trial Tr. Vol. II 81:21-25.
- 3) Additionally, Dr. Kavanaugh's analysis presumes that all of the coal ash would be excavated in 2010. Trial Tr. Vol. II 85:2-5. As noted above, it would take more than a decade for ash to be excavated and removed from the CEC site. Accordingly, Dr. Kavanaugh's opinion did not account for the fact that costs would be accrued in the future. Trial Tr. Vol. II 85:19-86:1.
- 4) Dr. Kavanaugh's analysis is based on EPA Guidance that is used for the purpose of calculating penalties for settlement purposes and not for the purpose of penalties following a trial. Trial Tr. Vol. II 45:1-46:2; 83:2:14 (Dr. Kavanaugh).

VIRGINIA ELECTRIC AND POWER COMPANY  
D/B/A DOMINION VIRGINIA POWER

By: /s/ Laura Anne Kuykendall  
Of Counsel

Brooks M. Smith (VSB No. 40171)  
Dabney J. Carr, IV (VSB No. 28679)  
Miranda R. Yost (VSB No. 72711)  
Laura Anne Kuykendall (VSB No. 82318)  
**TROUTMAN SANDERS LLP**

1001 Haxall Point  
P.O. Box 1122  
Richmond, Virginia 23218-1122  
Telephone: 804-697-1200  
Facsimile: 804-697-1339  
brooks.smith@troutmansanders.com  
dabney.carr@troutmansanders.com  
miranda.yost@troutmansanders.com  
la.kuykendall@troutmansanders.com

*Counsel for Defendant Virginia Electric  
and Power Co. d/b/a Dominion Virginia Power*

**CERTIFICATE OF SERVICE**

I hereby certify that on this 18th day of July, 2016, I electronically filed the foregoing with the Clerk of Court using the CM/ECF system, which then will send automatic notification of such filing (NEF) to the following:

Deborah M. Murray  
Bradford T. McLane  
Christopher J. Bowers  
Gregory Buppert  
William C. Cleveland  
Nathaniel H. Benforado  
Southern Environmental Law Center  
201 West Main Street, Suite 14  
Charlottesville, VA 22902-5065  
dmurray@selcva.org  
bmclane@selcva.org  
cbowers@selcga.org  
wcleveland@selcva.org,  
gbuppert@selcva.org  
nbenforado@selcva.org

/s/ Laura Anne Kuykendall  
Laura Anne Kuykendall (VSB No. 82318)  
**TROUTMAN SANDERS LLP**  
1001 Haxall Point  
P.O. Box 1122  
Richmond, Virginia 23218-1122  
Telephone: 804-697-1200  
Facsimile: 804-697-1339  
la.kuykendall@troutmansanders.com  
*Counsel for Defendant Virginia Electric and Power  
Company d/b/a Dominion Virginia Power*